

To: John Fortman

John D. Baranzelli

Subject:

Pavement Design

Date:

From:

November 8, 2012

FAI Route 94 (I-94) Cook County At Des Plaines River

We have reviewed the pavement design for the project, which was submitted to BDE by email dated October 23, 2012. The Life Cycle Cost Analysis favors the rigid pavement design by more than 10%.

Attn: District One

The approved pavement design is as follows:

Rand Road over Des Plaines River (Pavement Reconstruction)
9 inches of Jointed PCC Pavement with Tied PCC Curb & Gutter
12 inches of Aggregate Subgrade Improvement

Wilson Lane (Pavement Reconstruction)(Local Jurisdiction)

7 inches of Full Depth HMA Pavement with Tied PCC Curb & Gutter

2 inches of HMA Surface Course, Mix "D", N70

5 inches of HMA Binder Course, IL-19.0, N70

12 inches of Aggregate Subgrade Improvement

If you have any questions, please contact Paul Niedernhofer at (217) 524-1651.

To: John D. Baranzelli Attn: Paul Niedernhofer

From: John Fortmann By: Jose Dominguez

Subject: Pavement Analysis*

Date: October 23, 2012

*Route: Rand Road Contract No.: 60J10
Limits: At Des Plaines River Job No.: P-91-429-09
Section: 120-Y-B Current target: 08CY14

Section: 120-Y-B County: Cook

We have completed the pavement analysis for the above captioned location. Review by the Central Office is required since the total pavement area for reconstruction exceeds 4,750 Square Yards. The following is the scope of the project:

a) Pavement reconstruction of approximately 1884 feet of Rand Road from Elk Road to Ballard Road to accommodate the improved 5-lane section.

b) Pavement reconstruction of approximately 380 feet of Wilson Lane to accommodate the re-alignment.

A 20 year pavement analysis was performed on the above segments. We recommend a mechanistic-rigid pavement design for Rand Road based on the life cycle cost analysis which favors PCC pavement by over 13%.

Rand Road over Des Plaines River

PCC curb and gutter (tied)
Pavement Reconstruction
9" PCC Pavement (Jointed)¹
12" Aggregate Subgrade Improvement²

A segmental pavement analysis was performed on Wilson Lane and it is recommended to match-in-kind to existing pavement and use a flexible pavement design. Our recommendation is as follows:

Wilson Lane⁴

PCC curb and gutter (untied)
Pavement reconstruction

7" Full Depth Hot-Mix Asphalt Pavement³
2" Hot-Mix-Asphalt Surface Course, Mix "D", N50
5" Hot-Mix-Asphalt Binder Course, IL-19.0, N50

12" Aggregate Subgrade Improvement²

Pete Harmet October 23, 2012 Page Two

¹Designer Note 1: Use pay item #42000401, "PORTLAND CEMENT CONCRETE PAVEMENT, 9" (JOINTED)", paid in square yards. Transverse contraction joints should be reduced to a maximum of 14 foot spacing for 9" PCC pavement.

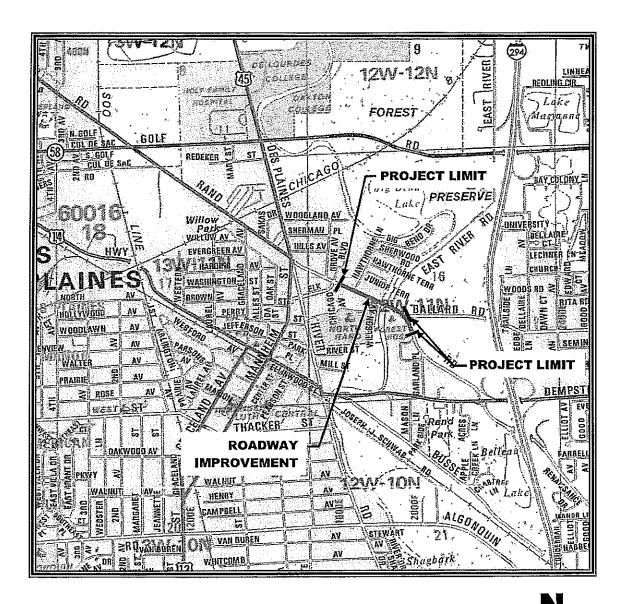
²Designer Note 2: Use pay item #30300112, "AGGREGATE SUBGRADE IMPROVEMENT, 12" " paid for in square yards.

³Designer Note 3: Use pay item # 40701821, "HOT-MIX ASPHALT (FULL-DEPTH), 7" ", paid in square yards.

⁴Designer note 4: Wilson Lane is subject to local jurisdictional approval and concurrence.

If you have any questions or need additional information, please contact Jenpai Chang, Interim Pavement Engineer, at (847) 705-4432.

Jose A. Dominguez, P.E. Project Support Engineer



Location Map

Proposed Improvement

Rand Road over Des Plaines River

Municipality: Des Plaines

County: Cook Route: FAU 3523

Project No.: P- 91-429-09 **Structure No.:** 016-0362



Figure 1

Printed: 11/07/2013

PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells) Route: Rand Rd (FAU 3523) Comments: Rand Road Reconstruction Section: 120-Y-B Over Des Plaines Rd County: Cook Design Date: <-- BY Location: Elk Blvd to Ballard Rd Modify Date: ADT <-- BY Year 27,400 2010 Current: Facility Type Other Marked State Route 29,400 2030 Future: # of Lanes = 4 Structural Design Traffic Minimum Actual %of % of ADT in Actual Road Class: ADT ADT Total ADT Design Lane PV = 97.7% 0 28,043 P= 32% Subgrade Support Rating (SSR): SU = 250 519 1.8% S= 45% Construction Year: 2013 MU = 750 138 0.5% M = 45% Design Period (DP) = (2023) Struct. Design ADT = 28,700 TRAFFIC FACTOR CALCULATION **FLEXIBLE PAVEMENT** RIGID PAVEMENT Cpv = 0.15 Cpv = 0.15 Csu = 132.5 Csu = 143.81 482.53 Cmu = Cmu = 696.42 TF flexible (Actual) = (Actual ADT) 1.24 TF rigid (Actual) = 1.56 (Actual ADT) TF flexible (Min) = 3.56 (Min ADT Fig. 54-2.C) TF rigid (Min) = (Min ADT Fig. 54-2.C) 5.02

NEW CONSTRUCTION	N / RECO	NSTRUCTION PAVE	MENT DESIGN CALCU	JLATIONS
Full-	JPC Pavement			
Use TF flexible PG Grade Lower Binder Lifts	The state of the s	(Fig. 53-4.R)	Use TF rigid = Edge Support =	5.02 Tied Shoulder or C.&G.
Goto Map HMA Mixture Temp.	= 74.0	deg. F (Fig. 54-5.C)	Rigid Pavt Thick. =	9.00 in. (Fig. 54-4.E)
Design HMA Mixture Modulus (E_{HMA}) Design HMA Strain (E_{HMA})		ksi (Fig. 54-5.D)		DO D
		(Fig. 54-5.E)		RC Pavement
Goto Map Full Depth HMA Design Thickness Limiting Strain Criterion Thickness	the resemble that the best sentences	in. (Fig. 54-5.F) in. (Fig. 54-5.I)	Use TF rigid = IBR value =	5.02 3
Use Full-Depth HMA Thickness	= 10.00	inches	CRCP Thickness =	8.00 in. (Fig. 54-4.M)

TF MUST BE > 60 FOR CRCP

RECONSTRUCTION ON	RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS								
HMA Over	HMA Overlay of Rubblized PCC								
Use TF flexible =	3.56		Review 54-4.03 for limitations and						
District =	3,4,5,6		special considerations.						
HMA Overlay Design Thickness =	8.00	in. (Fig. 54-5.U)	JPCP Thickness = NA inches						

CONTACT RMDD FOR ASSISTANCE

Class I Roads		Class II Roads		С	lass III Roa	ds	Class IV Re
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500		nes with ADT > 20 Street with ADT		(А	2 Lanes DT 750 -200	00)	2 Lanes (ADT < 75
		Design Traffic (Fig		l			able for
Facility Type	PV	SU	MU	1			y Streets
Interstate or Supplemental Freeway	0	500	1500			ADT	Class
Other Marked State Route Unmarked State Route	0 No Min	250 No Min	750 No Min			0 - 3500 >3501	11
Class I II III	Csu 143.81 135.78 129.58	Cmu 696.42 567.21 562.47	132.50 112.06 109.14	Cmu 482.53 385.44 384.35		not one-w ADT 0 - 749	e 4 lane & vay street) Class
IV	129.58	562.47	109.14	384.35		750 - 2000 >2000	III II
	Design L	ane Distribution Fa	actors For Str	uctural Desigr	n Traffic (Fig Urban	j. 54-2.B)	
Number of Lanes	Р	S	М	Р	S	М	
1 Lane Ramp	100%	100%	100%	100%	100%	100%	
2 or 3	50%	50%	50%	50%	50%	50%	
4	32%	45%	45%	32%	45%	45%	
6 or more	20%	40%	40%	8%	37%	37%	

BDE 5401 Template (Rev. 10/05/2012)

Printed: 11/07/2013

LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

Standard Design

FULL-DEPTH HMA	PAVEMENT						St
ROUTE SECTION COUNTY LOCATION			d (FAU 3523) 120-Y-B Cook to Ballard Rd	3			
FACILITY TYPE		NON-	INTERSTATE				
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH	HMA Inside HMA Outside		3 4 2 12 0	FT ==: CL LANES EP FT FT	> 0.36	Miles	
PAVEMENT THICKNESS SHOULDER THICKNESS POLICY OVERLAY THICKN			10.00 8.00 2.25	IN	14.50 Phase sea	IN MAX Standard	Design
FLEX PAVEMENT TRAF	FIC FACTORS		MINIMUM		ACTUAL		USE
			3.56		1.24		3.56
HMA COST PER TON					UNIT PRICE		Read Me!
HMA SURFACE HMA TOP BINDER HMA LOWER BINDER HMA BINDER (LEVELING) HMA SHOULDER					\$95.00 \$90.00 \$85.00 \$95.00 \$85.00	/TON /TON /TON	
INITIAL COSTS ITEM	THICKNE	SS 100°	% QUANTITY	UNIT	UNIT PRICE		COST
HMA PAVEMENT (FULL-	DEPTH) (10.0	0")	10,048	SQ YD	\$42.54	/SQ YD	\$427,442 ~
HMA SURFACE COURSE HMA TOP BINDER COURS HMA LOWER BINDER COU		5")	10,048 10,048 10,048	SQ YD	\$8.98 \$10.12 \$23.44		\$0 \$0 \$0
HMA SHOULDER CURB & GUTTER	(8.0	0")		TONS LIN FT	\$85.00 \$30.00	/TON /LIN FT	\$0 ~ \$0
SUBBASE GRAN MATL TY IMPROVED SUBGRADE:		jate Missis = 55.7		TONS SQ YD	\$25.00 \$10.00		\$500 \$106,060
Reserved For User Supplie Reserved For User Supplie				UNITS		/UNITS /UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL			10,048 0	SQ YD SQ YD		/SQ YD /SQ YD	\$0 \$0
Note: * Denotes User Supp	olied Quantity				ON INITIAL COST COST PER MILE		\$534,002 \$61,038
MAINTENANCE COSTS:	THICKNE	SS	MATERIAL		UNIT COST		
ROUTINE MAINTENANCE	ACTIVITY				\$0.00	LANE-MILE	/YEAR
HMA OVERLAY PVMT SUI	RF (2.0 (2.2		Surface Mix	x 233		/ SQ YD	
HMA SURFACE MIX	(1.5	0")	Surface Mix	x 1.55	\$7.50	/SQ YD	
HMA BINDER MIX HMA OVERLAY SHLD	(0.7 (Year 30) (2.2	5")	eling Binder Mit Shoulder Mit	x 2.25	\$11.25	/SQ YD	
HMA OVERLAY SHLD MILLING (2.00 IN)	(2.0	0")	Shoulder Mix	x 2.00 2.00		/SQ YD	
PARTIAL DEPTH PVMT PARTIAL DEPTH SHLD P			Surface Min			/SQ YD /SQ YD	
PARTIAL DEPTH PVMT PARTIAL DEPTH SHLD P			veling Binder Mi			/SQ YD /SQ YD	
LONGITUDINAL SHOULDE CENTERLINE JOINT ROUT RANDOM / THERMAL CRA	C& SEAL		o = 110.00' / Stat	tion / Lane)	\$2.00	/LIN FT /LIN FT /LIN FT	

FULL-DEPTH HMA PAVEMENT HMA OVERLAY OF RUBBLIZED PCC PAVEMENT Figure 54-7.C STANDARD DESIGN

WOF	COST	IIT COST	JNIT L	GOADUSCO BI	elesson per			
								YEAR 5
	\$7,536	\$2.00	INFT	3,768 L	100.00%		LONG SHLD JT R&S	The State of the S
	\$11,304	\$2.00	INFT	5,652 L	100.00%		CNTR LINE JOINT R&S	
	\$8,290	\$2.00	INFT	4,145 L	50.00%		RNDM / THRM CRACK R&S	
	\$908	\$90.83	QYD	10 S	0.10%		PD PVMT PATCH M&F SURF	
\$24,	\$28,038	0.8626 X	PW=		0.8626	PWFn =		
					/ASS. 50.5			YEAR 10
	\$7,536	\$2.00		3,768 L	100.00%		LONG SHLD JT R&S	
	\$11,304	\$2.00		5,652 L	100.00%		CNTR LINE JOINT R&S	
	\$8,290	\$2.00		4,145 L	50.00%		RNDM / THRM CRACK R&S	
\$23,	\$4,542 \$31,672	\$90.83 0.7441 X	PW=	50 S	0.50%	PWFn =	PD PVMT PATCH M&F SURF	
Ψ20,	ψ31,072	0.7441 X			0.7441		1	VEAD 45
	\$25,120	\$2.50	OYD	10,048 S	100.00%		MILL PVMT & SHLD 2.00"	YEAR 15
	\$9,083	\$90.83		100 S	1.00%	2 00"	PD PVMT PATCH M&F ADD'L	A STATE OF THE REAL PROPERTY AND ADDRESS OF THE PARTY AND ADDRESS OF TH
	\$100,480	\$10.00		10,048 S	100.00%	2.00	HMA OVERLAY PVMT 2.00"	THE RESIDENCE OF THE PARTY OF T
	\$100,480	\$10.00	QYD		100.00%		HMA OVERLAY SHLD 2.00 "	
\$86,	\$134,683	0.6419 X	PW=		0.6419	PWFn =	TOTAL TOTAL 2.30	
								YEAR 20
	\$7,536	\$2.00		3,768 L	100.00%		LONG SHLD JT R&S	
	\$11,304	\$2.00	IN FT	5,652 L	100.00%		CNTR LINE JOINT R&S	
	\$8,290	\$2.00	INFT	4,145 L	50.00%		RNDM / THRM CRACK R&S	
	\$908	\$90.83	QYD	10 S	0.10%		PD PVMT PATCH M&F SURF	
\$15	\$28,038	0.5537 X	PW=		0.5537	PWFn =		
								YEAR 25
	\$7,536	\$2.00		3,768 L	100.00%		LONG SHLD JT R&S	A STATE OF THE PARTY OF THE PAR
	\$11,304	\$2.00		5,652 L	100.00%		CNTR LINE JOINT R&S	
	\$8,290	\$2.00		4,145 L	50.00%		RNDM / THRM CRACK R&S	THE RESIDENCE OF THE PARTY OF T
\$15,	\$4,542 \$31,672	\$90.83 0.4776 X	Q YD PW =	50 S	0.50%	PWFn =	PD PVMT PATCH M&F SURF	
\$10,	Ψ01,072	0.4770 X			0.4770		HMA_SD	
			0.1/0	10.010.0	100.000/			YEAR 30
	\$25,120	\$2.50		10,048 S	100.00%	0.000	MILL PVMT & SHLD 2.00"	MARKET BERTHAMPER AND STREET
	\$18,257	\$90.83		201 S	2.00%		PD PVMT PATCH M&F ADD'L	
	\$0	\$89.71	QYD		1.00%	2.00"	PD SHLD PATCH M&F ADD'L	
	\$113,040	\$11.25		10,048 S	100.00%		HMA OVERLAY PVMT 2.25"	
\$64	\$156,417	\$11.25 0.4120 X	Q YD PW =	0 8	0.4120	PWFn =	HMA OVERLAY SHLD 2.25"	
								VEAD 25
	\$7,536	\$2.00	IN FT	3,768 L	100.00%		LONG SHLD JT R&S	YEAR 35
	\$11,304	\$2.00		5,652 L	100.00%		CNTR LINE JOINT R&S	
	\$8,290	\$2.00		4,145 L	50.00%		RNDM / THRM CRACK R&S	
	\$908	\$90.83	QYD		0.10%		PD PVMT PATCH M&F SURF	
\$9	\$28,038	0.3554 X	PW=		0.3554	PWFn =		
								YEAR 40
	\$7,536	\$2.00	IN FT	3,768 L	100.00%		LONG SHLD JT R&S	
	\$11,304	\$2.00	INFT	5,652 L	100.00%		CNTR LINE JOINT R&S	
	\$8,290	\$2.00	IN FT	4,145 L	50.00%		RNDM / THRM CRACK R&S	
	\$4,542	\$90.83	QYD	50 S	0.50%		PD PVMT PATCH M&F SURF	
\$9	\$31,672	0.3066 X	PW=		0.3066	PWFn =		
\$248,								
	\$0	0.00	ane Miles	1.43 L		IVITY	ROUTINE MAINTENANCE ACT	
\$248	CLE COST	ANCE LIFE-CY	MAINTE		7050			
\$28	PER MILE	ANNUAL COST	JIENANCE	MAIN	/852	CRFn = 0.0407	YEAR LIFE CYCLE	145

					WILL SHARE SHOWS		
PCC PAVEMENT							JPCP
ROUTE SECTION COUNTY LOCATION			d (FAU 3523) 120-Y-B Cook				
			to Ballard Rd				
FACILITY TYPE		NON-I	NTERSTATE				
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH PCC PCC	Inside Outside		3 4 2 12 0	FT ==> CL LANES EP FT FT FT	0.36	Miles	
PAVEMENT THICKNESS (RIGID) SHOULDER THICKNESS		JPCP	9.00 9.00		TIED SHLD		
POLICY OVERLAY THICKNESS			2.50	IN			
RIGID PAVEMENT TRAFFIC FAC	TORS		MINIMUM		ACTUAL		USE
Worksheet Construction Type is	Reconstruction		5.02	The Pa	1.56 vement Type is		5.02 JPCP
INITIAL COSTS ITEM	THICKNESS	1009	% QUANTITY	UNIT	UNIT PRICE		COST
JPC PAVEMENT	(9.00")		10,048	SQ YD	\$43.47	/ SQ YD	\$436,787
PAVEMENT REINFORCEMENT STABILIZED SUBBASE	(4.50")			SQ YD SQ YD *	\$0.00 \$15.00	/ SQ YD / SQ YD	\$0 \$0
PCC SHOULDERS CURB & GUTTER	(9.00" to 9.00")			SQ YD LIN FT	\$38.47 \$30.00	/SQ YD /LIN FT	\$0 \$0
SUBBASE GRAN MATL TY C IMPROVED SUBGRADE:	(~0.00") Aggregate			TONS * SQ YD *	\$25.00 \$10.00		\$500 \$106,060
Reserved For User Supplied Item Reserved For User Supplied Item				UNITS UNITS		/UNITS /UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL			10,048 0	SQ YD SQ YD		/ SQ YD / SQ YD	\$0 \$0
Note: * Denotes User Supplied Qua	antity	RIGID CON			NINITIAL COST		\$543,347 \$62,106
MAINTENANCE COSTS:	THICKNESS		MATERIAL		UNIT COST		
ROUTINE MAINTENANCE ACTIVIT	Y				\$0.00	/ LANE-MIL	E/YEAR
HMA POLICY OVERLAY HMA POLICY OVERLAY PVMT	(2.50")	1,0043		2.50	\$12.50	(SO VD	
HMA SURFACE MIX	(1.50")		Surface Mix			/SQ YD	
HMA BINDER MIX HMA POLICY OVERLAY SHLD	(1.00")	1,0069	eling Binder Mix Shoulder Mix	1.00		/SQ YD	
	(
CLASS A PAVEMENT PATCHING CLASS B PAVEMENT PATCHING CLASS C SHOULDER PATCHING					\$170.00 \$130.00 \$110.00	/ SQ YD	
PARTIAL DEPTH PVMT PATCH (N		Control of the Contro	Surface Mix Surface Mix		\$88.17 \$93.49		
LONGITUDINAL SHOULDER JOIN					\$2.00	/ LIN FT	
CENTERLINE JOINT ROUT & SEAL REFLECTIVE TRANSVERSE CRAC						/ LIN FT	
RANDOM CRACK ROUT & SEAL		ehab = 100.00'	/ Station / Lane)			/ LIN FT	

JOINTED PLAIN CONCRETE PAVEMENT UNBONDED JOINTED PLAIN CONCRETE OVERLAY Figure 54-7.A

PRESE WOR	COST		UNIT COST	UNIT	QUANTITY	%		ITEM	MAINTENANCE COSTS:
									YEAR 10
	\$1,300	NO.	\$130.00	SQ YD	10	0.10%		PAVEMENT PATCH CLASS B	
\$9	\$1,300	X	0.7441	PW=		0.7441	PWFn =		
									YEAR 15
	\$2,600	975	\$130.00	SQ YD	20	0.20%		PAVEMENT PATCH CLASS B	
\$1,6	\$2,600	X	0.6419	PW=		0.6419	PWFn =		
									YEAR 20
	\$26,130		\$130.00	SQ YD	201	2.00%		PAVEMENT PATCH CLASS B	
	\$0		\$110.00	SQ YD	0	0.50%		SHOULDER PATCH CLASS C	
	\$7,536		\$2.00	LIN FT	3,768	100.00%		LONGITUDINAL SHLD JT R&S	
	\$11,304		\$2.00	LINFT	5,652	100.00%		CENTERLINE JT R&S	
\$24,8	\$44,970	Х	0.5537	PW=		0.5537	PWFn =		
		200							YEAR 25
	\$39,130		\$130.00	SQ YD	301	3.00%		PAVEMENT PATCH CLASS B	
	\$0		\$110.00	SQ YD	0	1.00%		SHOULDER PATCH CLASS C	
\$18,6	\$39,130	X	0.4776	PW=		0.4776	PWFn =		
									YEAR 30
	\$52,260		\$130.00	SQ YD	402	4.00%		PAVEMENT PATCH CLASS B	
	\$0		\$110.00	SQ YD		1.50%		SHOULDER PATCH CLASS C	
	\$125,600		\$12.50		10,048	100.00%		HMA POLICY OVERLAY 2.5" (
	\$0		\$12.50	SQ YD	0	100.00%		HMA POLICY OVERLAY 2.5" (
\$73,2	\$177,860	X	0.4120	PW=		0.4120	PWFn =		
									YEAR 35
	\$7,536		\$2.00	LINFT	Charles of the Control of the Contro	100.00%		LONGITUDINAL SHLD JT R&S	
	\$11,304		\$2.00	LINFT		100.00%		CENTERLINE JT R&S	
	\$7,536		\$2.00	LINFT		50.00%		RANDOM CRACK R&S	
	\$4,838		\$2.00	LINFT		40.00%		REFLECTIVE TRANSVERSE CR	
	\$935		\$93.49	SQ YD	10	0.10%		PD PVMT PATCH M&F HMA 2	
\$11,4	\$32,149	X	0.3554	PW=		0.3554	PWFn =		
									YEAR 40
	\$6,500		\$130.00	SQ YD		0.50%		PAVEMENT PATCH CLASS B	
	\$7,536		\$2.00	LINFT		100.00%		LONGITUDINAL SHLD JT R&S	
	\$11,304		\$2.00	LINFT		100.00%		CENTERLINE JT R&S	
	\$7,258		\$2.00	LINFT	100000000000000000000000000000000000000	60.00%	RACK R&S	REFLECTIVE TRANSVERSE CF	
	\$7,536		\$2.00	LINFT		50.00%		RANDOM CRACK R&S	
155	\$4,675		\$93.49	SQ YD	50	0.50%		PD PVMT PATCH M&F HMA 2	
\$13,7 \$144,6	\$44,809	X	0.3066	PW=		0.3066	PWFn =		
	\$0		\$0.00	Lane Miles	1.42		VITY	ROUTINE MAINTENANCE ACTI	
\$144,6		= CV	ENANCE LIFE		1.43		VIII	ROOTINE WAINTENANCE ACTI	
	I OLL COOL	OST	LINAINOE LIFE	IVIMINI					

LIFE-CYCL	E COST ANALYSIS	: NEW DESIGN Calcul	ated / Revised :	10/22/12 10:45 AM	
COMPTRUCTION			JPCP	HMA	
CONSTRUCTION	INITIAL COST	PRESENT WORTH	\$543,347	\$534,002	
		ANNUAL COST PER MILE	\$62,106	\$61,038	
MAINTENANCE	LIFE-CYCLE COST	PRESENT WORTH	\$144,662	\$248,967	
		ANNUAL COST PER MILE	\$16,535	\$28,458	
TOTAL	LIFE-CYCLE COST	DDECENT MODELL	*****		
TOTAL	LIFE-CTCLE COST	PRESENT WORTH ANNUAL COST PER MILE	\$688,009 \$78,641	\$782,969 \$89,495	
LIFE-CYCL	E COST ANALYSIS	: FINAL SUMMARY			
LIFE-CYCL		: FINAL SUMMARY	JPCP	\$78,641	

P:\Pavement Design Stuff\D-1\Rand Road over the Des Plaines River 10-23-12\[Rand Road IDOT Mechanistic Pavement Design with LCCA 081412.xlsm]LifeCycle(

IDOT MECHANISTIC PAVEMENT DESIGN

Printed: 11/07/2013 PROJECT AND TRAFFIC INPUTS (Enter Data in Gray Shaded Cells) Route: Rand Rd (FAU 3523) Comments: Wilson Lane Reconstruction Section: 120-Y-B Over Des Plaines Rd County: Cook Design Date: <-- BY Location: Elk Blvd to Ballard Rd Modify Date: <-- BY ADT Year Current: 500 2010 Facility Type Unmarked State Route Future: 500 2030 # of Lanes = 2 or 3 Part of future 4 lanes or more ? No Structural Design Traffic One Way Street ? Minimum % of ADT in Actual Actual %of No Road Class: ADT ADT Total ADT IV Design Lane No Min PV = 490 98.0% P = 50% Subgrade Support Rating (SSR): SU = No Min 1 8% S= 50% Poor 9 Construction Year: MU = No Min 0.2% M = 50% 2013 1 Design Period (DP) = 20 Struct. Design ADT = 500 (2023)TRAFFIC FACTOR CALCULATION FLEXIBLE PAVEMENT RIGID PAVEMENT Cpv = 0.15 Cpv = 0.15 Csu = 109.14 Csu = 129.58 Cmu = 384.35 Cmu = 562.47 TF flexible (Actual) = 0.01 (Actual ADT) TF rigid (Actual) = 0.02 (Actual ADT)

	Full-Depth HMA Pavement			JPC Pavement		
	Use TF flexible =	0.50	Per BDE 54-5.01(i)-1g	Use TF rigid = 0.02		
	PG Grade Lower Binder Lifts =	PG 64-22	(Fig. 53-4.R)	Edge Support = Tied Shoulde	er or C.&G.	
Goto Map	HMA Mixture Temp. =	74.0	deg. F (Fig. 54-5.C)	Rigid Pavt Thick. = 999.00 in. (Fig.	54-4.E)	
Des	ign HMA Mixture Modulus (E _{HMA}) =	720	ksi (Fig. 54-5.D)	** USE FIG. 54-4.H AND 54-4	4.1 **	
	Design HMA Strain (ϵ_{HMA}) =	147	(Fig. 54-5.E)	CRC Pavement		
F	ull Depth HMA Design Thickness =	7.00	in. (Fig. 54-5.F)	Use TF rigid = 0.02		
Goto Map	miting Strain Criterion Thickness =	14.50	in. (Fig. 54-5.I)	IBR value = 3		
	Jse Full-Depth HMA Thickness =	7.00	inches	CRCP Thickness = 999.00 in. (Fig.	54-4.N)	
				TF MUST BE > 60 FOR CR	CP	

(Min ADT Fig. 54-2.C)

RECONSTRUCTION ONLY (SUPPLEMENTAL) PAVEMENT DESIGN CALCULATIONS **HMA Overlay of Rubblized PCC Unbonded Concrete Overlay** Use TF flexible = 0.50 Review 54-4.03 for limitations and special considerations. District = 3,4,5,6 HMA Overlay Design Thickness = 5.25 in. (Fig. 54-5.U) JPCP Thickness = NA inches

CONTACT BMPR FOR ASSISTANCE

No Min

(Min ADT Fig. 54-2.C)

TF rigid (Min) =

DESIGN TABLES FROM BDE MANUAL CHAPTER 54 - PAVEMENT DESIGN

Class I Roads	Class II Roads	Class III Roads	Class IV Roads
4 lanes or more Part of a future 4 lanes or more One-way Streets with ADT > 3500	2 lanes with ADT > 2000	2 Lanes	2 Lanes
	One way Street with ADT <= 3500	(ADT 750 -2000)	(ADT < 750)

	Min. Str. Design Traffic (Fig 54-2.C)					
Facility Type	PV	SU	MU			
Interstate or Supplemental Freeway	0	500	1500			
Other Marked State Route	0	250	750			
Unmarked State Route	No Min	No Min	No Min			

TF flexible (Min) =

No Min

	T	raffic Factor ESA	AL Coefficients	
	Rigid (F	Flexible (Fig. 54-5.E		
Class	Csu	Cmu	Csu	Cmu
	143.81	696.42	132.50	482.53
II	135.78	567.21	112.06	385.44
III	129.58	562.47	109.14	384.35
IV	129.58	562.47	109.14	384.35
				E TO SERVICE STATES

Class T	able for
One-Wa	y Streets
ADT	Class
0 - 3500	II
>3501	1

Class	Table for
2 or 3	lanes
(not futur	e 4 lane &
not one-v	vay street)
ADT	Class
0 - 749	IV
750 - 2000	III
>2000	ll ll

	Design Lane Distribution Factors For Structural Design Traffic (Fig. 54-						
		Rural			Urban		
Number of Lanes	Р	S	М	Р	S	М	
1 Lane Ramp	100%	100%	100%	100%	100%	100%	
2 or 3	50%	50%	50%	50%	50%	50%	
4	32%	45%	45%	32%	45%	45%	
6 or more	20%	40%	40%	8%	37%	37%	

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LIFE-CYCLE COST ANALYSIS: NEW CONSTRUCTION / RECONSTRUCTION

Standard Design

FULL-DEPTH HMA PAVEMENT						;
ROUTE SECTION COUNTY LOCATION		Rand Rd (FAU 3523) 120-Y-B Cook Blvd to Ballard Rd				
FACILITY TYPE		NON-INTERSTATE				
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH HMA Insid		430 1 2 2 12 0	FT ==> CL LANES EP FT FT	0.08	Miles	
PAVEMENT THICKNESS (FLEXIBLE) SHOULDER THICKNESS POLICY OVERLAY THICKNESS		7.00 8.00 2.25	IN	14.50	IN MAX Standar	d Design
FLEX PAVEMENT TRAFFIC FACTORS		MINIMUM		ACTUAL		USE
		No Min		0.01		No Min
HMA COST PER TON HMA SURFACE HMA TOP BINDER HMA LOWER BINDER HMA BINDER (LEVELING) HMA SHOULDER				UNIT PRICE \$95.00 \$90.00 \$85.00 \$95.00 \$85.00	/TON /TON /TON	Read Me
INITIAL COSTS ITEM THIC	KNESS	100% QUANTITY	UNIT	UNIT PRICE		COST
HMA PAVEMENT (FULL-DEPTH)	(7.00")	1,147	PO VD *	\$33.26	(SO VD	¢20 120
		1,147		\$13.50		\$38,138
HMA TOP BINDER COURSE HMA LOWER BINDER COURSE	(2.25") (2.75")	1,147 1,147	SQ YD		/ SQ YD	\$0 \$0
HMA SHOULDER	(8.00")	3 0	TONS	\$85.00	/TON	\$0
CURB & GUTTER		0	LIN FT	\$30.00	/LIN FT	\$0
SUBBASE GRAN MATL TY C (TONS) IMPROVED SUBGRADE: AG	gregate		TONS SQ YD	\$25.00 \$10.00		\$0 \$12,500
Reserved For User Supplied Item Reserved For User Supplied Item			UNITS		/ UNITS / UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL		1,147	SQ YD SQ YD		/SQ YD /SQ YD	\$0 \$0
Note: * Denotes User Supplied Quantity	EI EVIDI	FLEXIBLE CONS	TRUCTION	N INITIAL COST		\$50,638 \$25,360
MAINTENANCE COSTS:	KNESS		7111110712	UNIT COST		\$25,000
ROUTINE MAINTENANCE ACTIVITY	NNE33	MATERIAL			LANE-MIL	.E / YEAR
HMA OVERLAY PVMT SURF	(2.00")	Surface Mix		\$10.00	/ SQ YD	
HMA OVERLAY PVMT HMA SURFACE MIX	(2.25")	Surface Mix	2.2% # 535	\$11.25 \$7.50	/SQ YD	
HMA BINDER MIX	(0.75")	eling Binder Mix	9.78	\$3.75	/ SQ YD	
HMA OVERLAY SHLD (Year 30) HMA OVERLAY SHLD	(2.25")	Shoulder Mix Shoulder Mix		\$11.25 \$10.00		
MILLING (2.00 IN)					/ SQ YD	
	Fill Surf)	Surface Mix Shoulder Mix		\$90.83 \$89.71		
	1 +2.00 ")	Leveling Binder Mix		\$90.83 \$89.71	/SQ YD	
PARTIAL DEPTH SHLD PATCH (MIII & PI	1 +2.00 ")	Shoulder Mix		A CONTRACTOR OF THE PARTY OF TH		
LONGITUDINAL SHOULDER JOINT ROUT & CENTERLINE JOINT ROUT & SEAL		Shoulder Mix		\$2.00	/LIN FT /LIN FT	

FULL-DEPTH HMA PAVEMENT HMA OVERLAY OF RUBBLIZED PCC PAVEMENT Figure 54-7.C STANDARD DESIGN

ITENANCE COSTS:	ITEM	%	QUANTITY UNIT	UNIT COST	COST	PRESEN' WORTH
YEAR 5						
12/11	LONG SHLD JT R&S	100.00%	860 LINFT	\$2.00	\$1,720	
	CNTR LINE JOINT R&S	100.00%	430 LINFT	\$2.00	\$860	
	RNDM / THRM CRACK R&S	50.00%	473 LIN FT		Control of the Contro	
	PD PVMT PATCH M&F SURF	0.10%	1 SQ YD	\$2.00 \$90.83	\$946	
	PWFn =	0.8626	PW=	0.8626 X	\$91 \$3,617	\$3,120
YEAR 10						
ILAN 10	LONG SHLD JT R&S	100.00%	860 LIN FT	\$2.00	\$1,720	
	CNTR LINE JOINT R&S	100.00%	430 LIN FT	\$2.00	\$860	
	RNDM / THRM CRACK R&S	50.00%	473 LIN FT	\$2.00	\$946	
	PD PVMT PATCH M&F SURF	0.50%	6 SQ YD	\$90.83	\$545	40.000
	PWFn =	0.7441	PW=	0.7441 X	\$4,071	\$3,029
YEAR 15	THU DIATE OF DESCRIPTION	400.000				
	MILL PVMT & SHLD 2.00"	100.00%	1,147 SQ YD	\$2.50	\$2,868	
	PD PVMT PATCH M&F ADD'L 2.00"	1.00%	11 SQ YD	\$90.83	\$999	
	HMA OVERLAY PVMT 2.00"	100.00%	1,147 SQ YD	\$10.00	\$11,467	
	HMA OVERLAY SHLD 2.00 " PWFn =	0.6419	0 SQ YD PW=	\$10.00 0.6419 X	\$0 \$15,334	\$0.940
	FWFII =	0.0419	rvv=	0.0419 X	φ10,004	\$9,842
YEAR 20	LONG SHLD JT R&S	100.00%	960 LINET	\$2.00	\$1.700	
		100.00%	860 LIN FT	\$2.00	\$1,720	
	CNTR LINE JOINT R&S RNDM / THRM CRACK R&S	100.00%	430 LIN FT 473 LIN FT	\$2.00 \$2.00	\$860 \$946	
	PD PVMT PATCH M&F SURF					
	PWFn =	0.10%	1 SQ YD PW=	\$90.83 0.5537 X	\$91 \$3,617	\$2,003
V545 05						
YEAR 25	LONG SHLD JT R&S	100.00%	860 LINFT	\$2.00	64 700	
	CNTR LINE JOINT R&S	100.00%	430 LIN FT	\$2.00	\$1,720 \$860	
			473 LIN FT		THE RESERVE AND ADDRESS OF THE PARTY.	
	RNDM / THRM CRACK R&S PD PVMT PATCH M&F SURF	50.00% 0.50%	6 SQ YD	\$2.00 \$90.83	\$946 \$545	
	PWFn =	0.4776	PW=	0.4776 X	\$4,071	\$1,944
VEAD OO	HMA_SD					
YEAR 30	NON-INTERSTATE MILL PVMT & SHLD 2.00"	100.00%	1,147 SQ YD	\$2.50	\$2,868	
	PD PVMT PATCH M&F ADD'L 2.00"	2.00%	23 SQ YD	\$90.83	\$2,089	
	PD SHLD PATCH M&F ADD'L 2.00"	1.00%	0 SQ YD	\$89.71	\$2,009	
	HMA OVERLAY PVMT 2.25 "	100.00%	1,147 SQ YD	\$11.25	\$12,900	
	HMA OVERLAY SHLD 2.25 "	100.00%	0 SQ YD	\$11.25	\$12,500	
	PWFn =	0.4120	PW=	0.4120 X	\$17,857	\$7,357
YEAR 35						
TEAR 35	LONG SHLD JT R&S	100.00%	860 LINFT	\$2.00	\$1,720	
	CNTR LINE JOINT R&S	100.00%	430 LIN FT	\$2.00	\$860	
	RNDM / THRM CRACK R&S	50.00%	473 LIN FT	\$2.00	\$946	
	PD PVMT PATCH M&F SURF	0.10%	1 SQ YD	\$90.83	\$91	
	PWFn =	0.3554	PW=	0.3554 X	\$3,617	\$1,285
YEAR 40						
	LONG SHLD JT R&S	100.00%	860 LINFT	\$2.00	\$1,720	
	CNTR LINE JOINT R&S	100.00%	430 LINFT	\$2.00	\$860	
	RNDM / THRM CRACK R&S	50.00%	473 LIN FT	\$2.00	\$946	
	PD PVMT PATCH M&F SURF	0.50%	6 SQ YD	\$90.83	\$545	
	PWFn =	0.3066	PW=	0.3066 X	\$4,071	\$1,248
					-	\$29,828
	ROUTINE MAINTENANCE ACTIVITY		0.16 Lane Mile	€ 0.00	\$0	\$0
	TOO THE MAINTENANCE ACTIVITY			TENANCE LIFE-CY		\$29,828
45	YEAR LIFE CYCLE CRFn = 0.040	7952		CE ANNUAL COST		\$14,938

PCC PAVEMENT			JPCP
ROUTE SECTION COUNTY	Rand Rd (FAU 3523) 120-Y-B Cook		
LOCATION	Elk Blvd to Ballard Rd		
FACILITY TYPE	NON-INTERSTATE		
PROJECT LENGTH # OF CENTERLINES # OF LANES # OF EDGES LANE WIDTH - AVERAGE SHOULDER WIDTH PCC Inside PCC Outside	430 FT === 1 CL 2 LANES 2 EP 12 FT 0 FT 0 FT	> 0.08 Miles	
PAVEMENT THICKNESS (RIGID) SHOULDER THICKNESS	JPCP 6.50 IN 6.50 IN	TIED SHLD	
POLICY OVERLAY THICKNESS	2.50 IN		
RIGID PAVEMENT TRAFFIC FACTORS	MINIMUM	ACTUAL	USE
Worksheet Construction Type is Reconstruction	No Min User Override P	0.02 avement Type is	No Min JPCP
INITIAL COSTS			
ITEM THICKNESS	100% QUANTITY UNIT	UNIT PRICE	COST
JPC PAVEMENT (6.50")	1,147 SQ YD	\$41.27 /SQYD	\$47,337
PAVEMENT REINFORCEMENT STABILIZED SUBBASE (4.50")	0 SQ YD 0 SQ YD	\$0.00 /SQYD \$15.00 /SQYD	\$0 \$0
PCC SHOULDERS (6.50" to 6.50") CURB & GUTTER	0 SQ YD 0 LIN FT	\$36.27 / SQ YD \$30.00 / LIN FT	\$0 \$0
SUBBASE GRAN MATL TY C (~ 0.00") IMPROVED SUBGRADE: Aggregate	0 TONS 1,250 SQ YD	\$25.00 /TON \$10.00 /SQYD	\$0 \$12,500
Reserved For User Supplied Item Reserved For User Supplied Item	0 UNITS 0 UNITS	\$0.00 / UNITS \$0.00 / UNITS	\$0 \$0
PAVEMENT REMOVAL SHOULDER REMOVAL	1,147 SQ YD 0 SQ YD	\$0.00 /SQYD \$0.00 /SQYD	\$0 \$0
Note: * Denotes User Supplied Quantity	RIGID CONSTRUCTION ANNUAL		\$59,837 \$20,067
	MIGID CONSTRUCTION ANNOAL	COST FER WILL	\$29,967
MAINTENANCE COSTS:			
ITEM THICKNESS	MATERIAL	UNIT COST	
ROUTINE MAINTENANCE ACTIVITY		\$0.00 / LANE-N	IILE / YEAR
HMA POLICY OVERLAY (2.50") HMA POLICY OVERLAY PVMT (2.50")	1.00EY 2.50	\$12.50 / SQ YD]
HMA SURFACE MIX (1.50")	Surface Mix 1.56	\$7.50 / SQ YD	
HMA BINDER MIX (1.00") HMA POLICY OVERLAY SHLD (2.50")	eling Binder Mix Shoulder Mix	\$5.00 / SQ YD \$12.50 / SQ YD	
TIMA FOLICT OVERLAT SHED (2.50)	Shoulder Mix 225	\$12.50 /SQ TD	
CLASS A PAVEMENT PATCHING		\$170.00 /SQ YD	
CLASS B PAVEMENT PATCHING CLASS C SHOULDER PATCHING		\$130.00 / SQ YD \$110.00 / SQ YD	
PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA Surf PARTIAL DEPTH PVMT PATCH (Mill & Fill HMA 2.50		\$88.17 /SQYD \$93.49 /SQYD	
LONGITUDINAL SHOULDER JOINT ROUT & SEAL		\$2.00 / LIN FT	
CENTERLINE JOINT ROUT & SEAL REFLECTIVE TRANSVERSE CRACK ROUT & SEAL		\$2.00 /LIN FT \$2.00 /LIN FT	
	ehab = 100.00' / Station / Lane)	\$2.00 /LINFT	
		Maria Contraction	

JOINTED PLAIN CONCRETE PAVEMENT UNBONDED JOINTED PLAIN CONCRETE OVERLAY Figure 54-7.A

UNIT	LIMIT	QUANTITY	%		ITEM	MAINTENANCE COSTS:
	ONT	QUARTITI	70		MEM	WINTERWAYOL OSCIO.
						YEAR 10
	SQ YD	1	0.10%		PAVEMENT PATCH CLASS B	
-	PW=		0.7441	PWFn =		
						YEAR 15
\$	SQ YD	2	0.20%		PAVEMENT PATCH CLASS B	
=	PW=		0.6419	PWFn =		
						YEAR 20
\$	SQ YD	23	2.00%		PAVEMENT PATCH CLASS B	
\$	SQ YD		0.50%		SHOULDER PATCH CLASS C	
	LINFT		100.00%		LONGITUDINAL SHLD JT R&S	
	LINFT		100.00%		CENTERLINE JT R&S	
= 2	PW=	450	0.5537	PWFn =	OCIATEINEMAC ST TAGO	
S	SQ YD	31	3.00%		PAVEMENT PATCH CLASS B	YEAR 25
\$	SQ YD		1.00%		SHOULDER PATCH CLASS C	
	PW=		0.4776	PWFn =	GHOOLDER PATCH CLASS C	
						YEAR 30
\$	SQ YD		4.00%		PAVEMENT PATCH CLASS B	
\$						
		0			HMA POLICY OVERLAY 2.5"	
			0.4120	- WI II -		
						YEAR 35
	LINFT	430	100.00%			
	LINFT	430	50.00%		RANDOM CRACK R&S	
	LINFT	278	40.00%	RACK R&S	REFLECTIVE TRANSVERSE CF	
	and the second	1	0.10%	Provide the second	PD PVMT PATCH M&F HMA 2	
=	PW=		0.3554	PWFn =		
					NON-INTERSTATE	YEAR 40
S	SQ YD	6	0.50%		PAVEMENT PATCH CLASS B	
	LINFT	860	100.00%		LONGITUDINAL SHLD JT R&S	
				PACK R&S		
				U TOTT TOO		
				50"		
	PW=	0	0.3066	PWFn =	PD PVMT PATCH M&F HMA 2	
					PD PVMI PAICH M&F HMA 2	
	PW=			PWFn =		
	PW =			PWFn =	ROUTINE MAINTENANCE ACTI	
		SQ YD SQ YD PW= LIN FT LIN FT LIN FT LIN FT SQ YD PW= SQ YD SQ YD LIN FT	1,147 SQ YD 0 SQ YD PW= 860 LIN FT 430 LIN FT 430 LIN FT 1 SQ YD PW= 6 SQ YD 860 LIN FT 430 LIN FT	100.00% 1,147 SQ YD 100.00% 0 SQ YD 0.4120 PW = 100.00% 860 LIN FT 100.00% 430 LIN FT 50.00% 430 LIN FT 40.00% 278 LIN FT 0.10% 1 SQ YD 0.3554 PW = 0.50% 6 SQ YD 100.00% 860 LIN FT 100.00% 860 LIN FT 100.00% 430 LIN FT 60.00% 418 LIN FT	(PVMT) 100.00% 1,147 SQ YD (SHLD) 100.00% 0 SQ YD PWFn = 0.4120 PW = 100.00% 860 LIN FT 100.00% 430 LIN FT 50.00% 430 LIN FT 2.50" 0.10% 1 SQ YD PWFn = 0.3554 PW = 0.50% 6 SQ YD 5 100.00% 860 LIN FT 100.00% 860 LIN FT 100.00% 860 LIN FT 100.00% 860 LIN FT 100.00% 430 LIN FT 100.00% 430 LIN FT 430 LIN FT 50.00% 430 LIN FT 430 LIN FT 50.00% 430 LIN FT 430 LIN FT	HMA POLICY OVERLAY 2.5" (PVMT)

INITIAL COST	PRESENT WORTH ANNUAL COST PER MILE	JPCP \$59,837 \$29,967	HMA \$50,638 \$25,360	
	ANNUAL COST PER MILE	\$29,967	\$25.360	
LIFE-CYCLE COST	PRESENT WORTH	\$17,003	\$29,828	
			ψ11,000	
LIFE-CYCLE COST	PRESENT WORTH	\$76,840	\$80,466	
	ANNUAL COST PER MILE	\$38,482	\$40,298	
E COST ANALYSIS	S: FINAL SUMMARY			
ION ======	======>	JPCP	\$38,482	
		ANNUAL COST PER MILE LIFE-CYCLE COST PRESENT WORTH	ANNUAL COST PER MILE \$8,515 LIFE-CYCLE COST PRESENT WORTH \$76,840 ANNUAL COST PER MILE \$38,482	ANNUAL COST PER MILE \$8,515 \$14,938 LIFE-CYCLE COST PRESENT WORTH \$76,840 \$80,466 ANNUAL COST PER MILE \$38,482 \$40,298